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Forest Health Protection
Pacific Southwest Region

Date: January 11, 2007
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To: Forest Supervisor, Lassen National Forest

Subject: Evaluation of Caribou and Thousand Lakes Wilderness Areas, Lassen National Forest (FHP Report NE07-01)

At the request of Elizabeth Norton, Resource Staff Manager, Lassen National Forest, I conducted a field evaluation of the Caribou and Thousand Lakes Wilderness Areas on October 24 and 25, 2006. The objective of my visit was to evaluate the current forest health conditions, including impacts to tree health from recreational use within the wilderness areas and discuss potential management options such as campsite relocation and closure, prescribed fire, and vegetation management. Elizabeth Norton, Bob Andrews, and Kevin McCombe accompanied me in the Caribou Wilderness. Elizabeth Norton accompanied me in the Thousand Lakes Wilderness.

Background

The Caribou Wilderness (CW) is located within the Lassen National Forest adjacent to the east boundary of Lassen Volcanic National Park. The general legal description is T30N, T31N and R7E. The average elevation is 6,900 feet and the 20,000 acre area receives an average of 50-60" of precipitation per year (Figure 1). Taylor and Solem (2001) identified 5 forest compositional groups within the CW: white fir – Jeffrey pine, red fir – white fir, lodgepole, red fir – lodgepole and red fir – western white pine. These stand types are mostly separated by soil properties and slope aspect. Lodgepole pine is the dominant stand type over much of the CW. No timber harvest has occurred within the wilderness boundary however grazing in the 19th century altered the fire regime by removing fine fuels (Taylor and Solem 2001). Tree mortality is ongoing for all species (Forest Health Protection aerial survey, 1996-2006).

The Thousand Lakes Wilderness (TLW) is located within the Lassen National Forest, Hat Creek Ranger District, near the community of Old Station, CA. The general legal description is T33N

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and R3E. The elevation ranges from 5,546 to 8,677 feet. The highest point is Crater Mountain, which is the dominant topographic feature in the wilderness. The average annual precipitation for this 16,000 acre area is approximately 50" (Figure 1) with lower amounts falling on the eastern flanks of Crater Mountain. Bekker and Taylor (2000) identified 5 forest compositional groups within the TLW: white fir – sugar pine, white fir – Jeffrey pine, red fir – white fir, lodgepole and red fir – mountain hemlock. These stand types are separated mostly by elevation and aspect. No vegetation management has occurred within the wilderness boundary and the impacts of late 19th century livestock grazing did not alter the fire regime (Bekker and Taylor 2000). Bark beetle caused tree mortality is dramatic in this area based on ten years of Forest Health Protection aerial surveys.

Management objectives for both wilderness areas include maintaining wilderness in such a manner that ecosystems are unaffected by human manipulation and influences so that plants and animals develop and respond to natural forces. However, the Forest Service fire suppression policy has applied to both wilderness areas since 1905, effectively removing fire from the ecosystem.

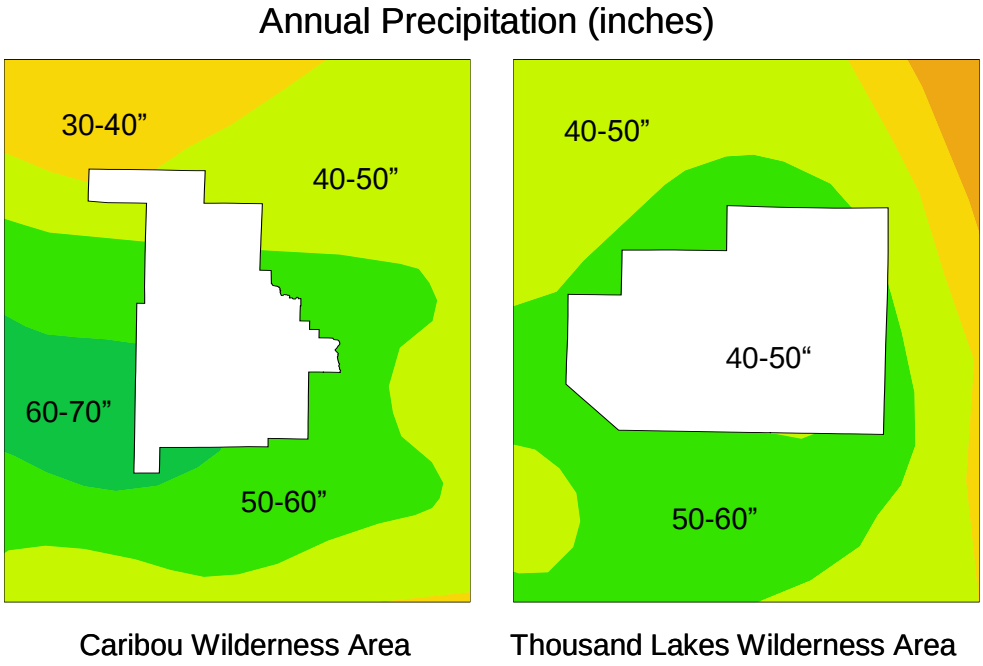

Figure 1. Isohyetal maps for Caribou and Thousand Lakes Wilderness Areas.

Observations

Caribou Wilderness

Current bark beetle activity and associated tree mortality is at background levels (<0.1 tree/acre) throughout most of the CW. The notable exceptions are a couple of areas in the southern end of the wilderness area that have a few scattered true fir and lodgepole pine that have been attacked and killed by the fir engraver beetle (*Scolytus ventralis*) and the mountain pine beetle (*Dendroctonus ponderosae*) respectively.

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Nearly all forested areas appear to be at or above "normal" stocking levels and in drier years exhibit an elevated level of tree mortality caused by bark beetles (Figure 2). This mortality combined with high stand density is resulting in heavy fuel loading. The presence of countless standing dead and downed trees, primarily lodgepole and true fir, throughout the area is evidence of the mortality that has occurred during drier years. A very high level of mortality occurred during the last prolonged drought period between 1987 and 1992.

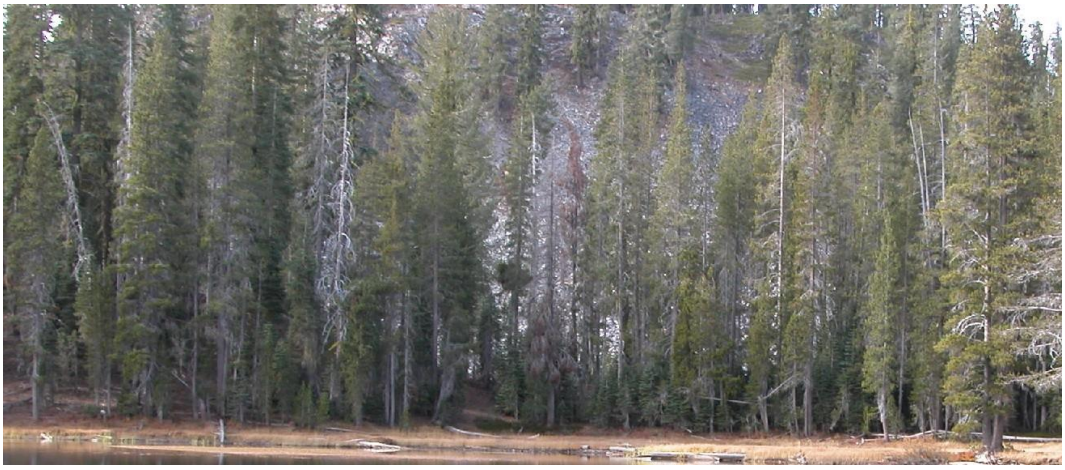

Figure 2. Dense stand consisting of lodgepole, red fir and western white pine.

Mortality is occurring in a few western white pines due to a combination of white pine blister rust (*Cronartium ribicola*) infections and mountain pine beetle (*Dendroctonus ponderosae*) attacks. Western white pine is also exhibiting limited regenerating due to several factors such as shading and competition from true fir and the build up of duff and litter on the forest floor.

Prescribed under burning at the south end of the CW has resulted in elevated levels of lodgepole pine and large diameter western white pine mortality.

Stalactiform rust (*Peridermium stalactiforme*) was observed in lodgepole pine around a few of the lakes (Figure 3). One lodgepole pine appears to have failed at the point of a decayed stalactiform rust bole canker (Figure 4). This tree was in the vicinity of a primitive campsite. Many lodgepole pines around the CW lakes have evidence of bole decay that may be due to

Figure 3. Bole canker caused by stalactiform rust.

Figure 4. Tree failure due to advanced decay associated with rust canker.

previous injuries that exposed sapwood to decay fungi rather than being associated with stalactiform rust.

Thousand Lakes Wilderness

Similar to the CW, but too a greater degree, nearly all forested areas within the TLW appear to be at above "normal" stocking levels and in drier years exhibit an elevated level of tree mortality caused by bark beetles, especially in lodgepole pine stands. This mortality combined with high stand density is resulting in extremely heavy fuel loading.

Bark beetle mortality has been elevated to extreme within the TLW over the past 20 years and perhaps longer. Several large areas of lodgepole have had over 50% mortality from mountain pine beetle attacks. White fir mortality is mostly scattered where this species is the dominant stand component, but many snags and downed trees exist as evidence of high levels of mortality during the last extended drought period (1987-1992). Also, over the past few years, many large diameter Jeffrey pines have been attacked and killed by the Jeffrey pine beetle (Figure 5). These trees were growing at about a 30 to 50 foot average spacing and were surrounded by an extremely dense understory of white fir (>500 stems/acre).

Scattered red fir at the higher elevations have been attacked and killed by the fir engraver beetle. These trees were weakened by a combination of dwarf mistletoe (*Arceuthobium abietinum* f.sp. *magnificae*) (Figure 6) and cytospora canker (*Cytospora abietis*) infections.

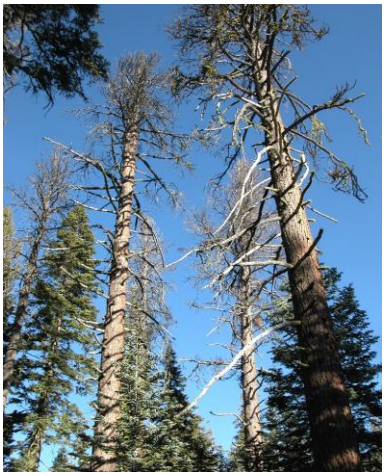

Figure 5. Old growth Jeffrey pine mortality.

Figure 6. Red fir limb infected with dwarf mistletoe.

Observations Common to Both Wilderness Areas

Hazard trees are present along most trails, around trailhead parking areas and around most primitive campsites. These trees are either standing snags or green trees with major structural defects.

Lodgepole pine dwarf mistletoe (*Arceuthobium americanum*) has infected a few lodgepole pines causing bole and limb swellings, brooming and reduced vigor as indicated by thinning crowns.

There is evidence of mechanical injury on many trees near campsites resulting from campers

hammering nails into trees and cutting into trees with hatchets or saws (Figures 7 and 8). Some of these trees have been severely injured. Soil compaction is also apparent within the campsites but does not appear to be negatively affecting tree health. However, in the TLW, ground pawing by pack horses that have been tied to tree boles is creating large holes, exposing and damaging the fine roots.

Figure 7. Bole injury to lodgepole pine

Figure 8. Bole injury to mountain hemlock

Discussion

Most of the forested portions of both the CW and the TLW are typical for drier western coniferous forests and lodgepole pine forests that have had fire excluded for 100+ years. These stands all share common characteristics such as high accumulations of fuels, dense understories made up of mostly shade tolerant species, such as red and white fir, mortality occurring from insects and disease, primarily in the larger trees, and limited regeneration of mostly shade intolerant tree species such as lodgepole pine, western white pine, ponderosa and Jeffrey pine.

Few vegetation management options are available to land managers for wilderness areas. Building roads and carrying out timber stand improvement and thinning activities are not permitted. Cutting trees and other vegetation is only allowed under special circumstances such as fire, insect and disease outbreaks (mainly for controlling exotic invasive species) or when protecting public safety. Prescribed fire may be used to alter forest structure but it is critical to know something about the historic stand structure and fire regime in order to best apply this management tool.

Most forest stands in the both the CW and the TLW areas are outside their range of natural variability in terms of fire frequency based on recent fire history studies (Bekker and Taylor 2000, Taylor and Solem 2001). These stands are dense, especially in the understories, full of both standing and downed dead trees and have changed species composition away from shade intolerant species such as pines towards shade tolerant true firs.

Recommendations

Management Alternatives

Do nothing: The no management alternative would allow the older and more decadent Jeffrey, ponderosa and western white pines, true firs and lodgepole, growing under dense stand conditions, to eventually succumb to bark beetle attacks. Dwarf mistletoe infections will likely expand in range and intensify within currently infested stands, further reducing tree health and vigor. Stand density will continue to increase over time, consisting mostly of small diameter red fir and white fir. Occasionally high levels of tree mortality are likely to occur, for all size classes and species, during extended periods of below normal precipitation. Western white, ponderosa and Jeffrey pine will occupy an even smaller percentage of the stands due to limited regeneration and mortality of mature trees. Over time, this trend will result in stands that are more densely stocked with smaller diameter trees and that have extremely heavy fuel loads. Fuel loads will continue to increase creating a higher risk of high intensity and stand replacing fire across all forest types. Although stand replacing fires may not be ecologically destructive to the red fir – hemlock, red fir – lodgepole and lodgepole stands (all long fire return interval forest types), it will likely be devastating in terms of tree mortality and subsequent regeneration for any Jeffrey pine – white fir and ponderosa pine - white fir stands (both short fire return interval forest types) that have potentially missed up to 20 fire intervals over the past 120 years. These areas will likely become shrub fields for many years after such an event.

Rx Fire: Consideration should be given to developing a long-term prescribed and natural fire use plan, if not already in place, to strategically return fire as a natural ecosystem process. Many of the insect and disease related issues found in these wilderness areas are a result of a general homogenizing of tree ages (most trees now in older age classes) and overstocked stand conditions in the absence of fire. Historically, low, moderate and high severity fires occurred relatively frequently within the wilderness areas, regenerating stands and selecting for more pine dominated forests (Bekker and Taylor 2000, Taylor and Solem 2001).

If restoring a natural fire regime in the wilderness areas is a management goal, fires will need to be within their historic range of variability in terms of acreage burned and intensity. Taylor and Solem (2001) found the average fire extent in the CW to be approximately 375 acres burning at mostly moderate intensity. Bekker and Taylor (2000) found the average fire in the TLW to be approximately 750 acres mostly burning at moderate to high intensity. They also describe historic fires in the lodgepole forest of the TLW as averaging 1000 acres in size with most of the area burning at moderate to high intensity. Clearly, any moderate or high intensity fire occurring within the CW or the TLW will have a high probability spreading to adjacent non-wilderness lands. Therefore, these adjacent lands will need to have sufficient, large scale fuel reduction treatments completed in order to significantly reduce fire intensity and facilitate fire suppression efforts.

Light underburning, which is the typical prescription for most controlled burns, cannot be expected to promote the regeneration of lodgepole pine on a historic scale and may actually reduce its presence within treated stands. Most lodgepole, which have very thin bark, will likely be killed during low intensity fires but the medium to large red fir present in the stand will not. This not only favors the retention of true fir but it also does not consume the fuel and open up the

stand to the degree necessary to promote large amounts of lodgepole regeneration. The shaded environment will likely persist and continue to favor true fir regeneration. This result was observed in a prescribed underburn area in the southern portion of the CW.

For ponderosa pine – white fir and Jeffrey pine – white fir forest types, prescribed fire alone under dense stand conditions may cause excessive tree mortality and actually increase the amount of fuels post fire. Dense understories of small trees serve as ladder fuels and can carry fire up into the crowns of overstory trees. If there is any possibility of thinning and removing understory trees and reducing dead fuels in the Jeffrey pine – white fir stands, especially in the TLW, it should be considered before fire is reintroduced. In a nearby fire history study in Lassen Volcanic National Park, Taylor (2000) also suggested that managers should consider physical manipulation of fuels before reintroducing fire into Jeffrey pine and Jeffrey pine – white fir forests in order to minimize mortality of large diameter trees.

Mature pines, including sugar and western white pines, are also especially susceptible to mortality during prescribed burns because of the deep duff and litter that accumulates at their base. These duff mounds typically burn at a slow rate, while maintaining lethal temperatures, causing severe cambium injury. Cambium injury was observed on western white pine in the prescribed underburn in the southern portion of the CW. For this reason, it may be beneficial to rake the duff away from the bases of large pines before burning.

Western white pine and sugar pine should be protected as much as possible during any prescribed burning operation in order to preserve genetic diversity, especially white pine blister rust (*Cronartium ribicola*) resistant individuals. White pine blister rust, a non-native pathogen, has continued to weaken and kill this species over most of its range since its introduction into the Pacific Northwest in 1910. Identification and protection of local rust resistant trees for seed collection, if not already occurring, will aid in the future planting of rust resistant seedlings. Planting selected openings created by prescribed or wildland fire with rust resistant stock would help insure this species persists in the area.

Other management considerations

Trees adjacent to campsites in both wilderness areas are exposed to additional stress factors that can compromise their health and vigor. Firewood collecting sometimes leads to tree wounding from hatchets and saws, tree bole carving and chopping causes extensive damage to bark and sapwood, and foot and horse traffic from backpackers and horse packers can result in increased soil compaction and root damage.

Tree wounding by careless backpackers and horse packers is a significant issue in both the CW and the TLW. To help prevent human and livestock caused tree injuries, which have the potential of creating hazard trees or even causing tree mortality, a public awareness poster should be placed at trailheads to inform campers about the importance of trees to the area and the problems associated with tree wounding from hatchets, axes, knives and nails or by gnawing and pawing by pack animals.

The hazard trees present within both wilderness areas are a serious problem. In any campground, recreation or administrative site, they would most likely be removed. In a

wilderness area, where tree cutting is discouraged, options for land managers are typically limited to informing campers of the dangers of hazard trees by providing information at trailheads and in wilderness brochures and by trying to direct campers away from hazardous trails and campsites. Unfortunately, most lakeshores within both wilderness areas, where the majority of the camping and recreational activities take place, have a high number of snags and green hazard trees and few options, if any; exist for directing people to other areas. Therefore, the Forest should consider removing the hazard trees from selected campsites and other high use areas. Vegetation may be cut in wilderness areas for the purposes of protecting public safety (FS Handbook 2323.52 #4). If hazard tree removal is not a realistic option than some campsites with very high numbers of hazard trees and snags should be closed by removing rock fire rings and scattering large limbs and branches throughout the site to discourage further use. In trailhead parking areas, which are located outside of wilderness boundaries, all standing dead and hazardous green trees within striking distance of the parking area should be removed as soon as possible.

Conclusion

Similar to most forests in the west, both the CW and TLW forested areas have experienced a significant amount of change in forest structure, fuel loading and species composition over the past 100 to 150 years. These changes are not easily reversed with the limited tools available for wilderness vegetation management. Reintroducing fire is the most realistic alternative for restoring forest ecosystem processes. However, careful planning and implementation will be required to achieve the desired results and not add to the already significant forest health problem that has developed in the absence of fire. All prescribed fire areas should be monitored through time to see if management objectives are being met and to gain additional information for implementing future burns.

Forest Health protection can assist with the planning of prescribed fire treatments to help mitigate potential losses of desired trees, especially large diameter pines and firs that make up the historic stand structure in many areas. FHP can also assist with post-burn evaluations to monitor tree mortality and any associated bark beetle activity.

If you have any questions regarding this report and/or need additional information please contact me at 530-252-6431.

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